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Turley et al.

[11] **4,277,093**

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[54] **SAFETY HOOK DEVICE**

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[51] **Int. Cl.**[3] **B66C 1/36**

[52] **U.S. Cl.** ..... **294/83 R**; 294/104

[58] **Field of Search** ..... 294/67 AB, 83 R, 84, 294/86 R, 91, 103 R, 104; 24/241 P, 241 PP, 241 PL, 241 SB, 241 SP

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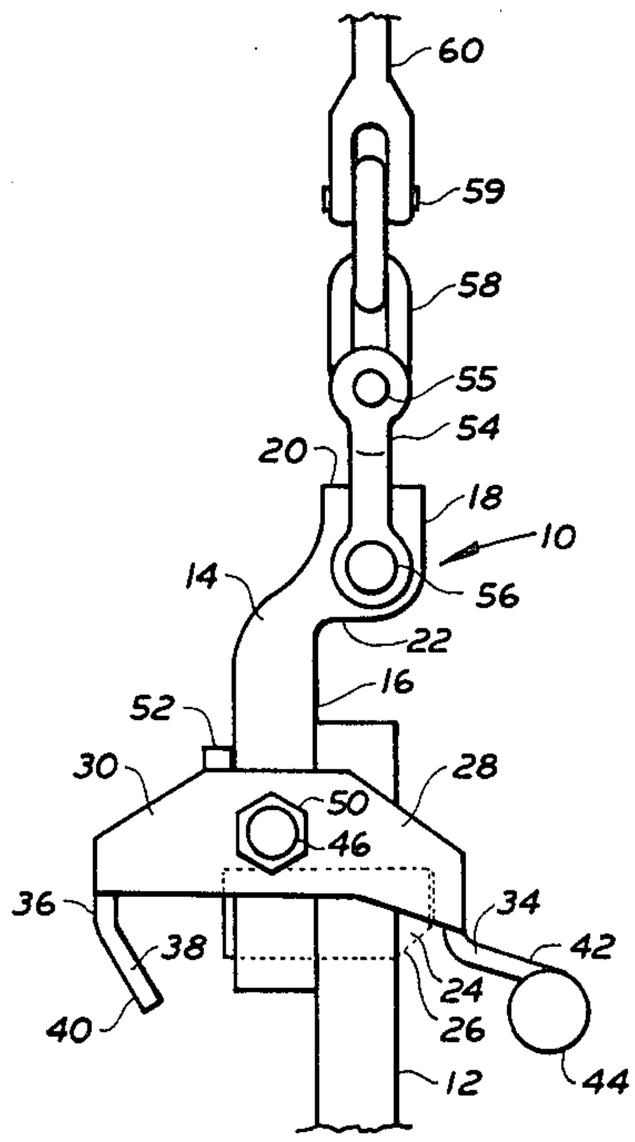
[57] **ABSTRACT**

A safety hook device used to couple with objects to be transported overhead is disclosed having a coupling rod at least partially enclosed within a rotatable housing when coupled with the object so that the danger of involuntary uncoupling is lessened. This invention is also adapted to provide for automatic coupling and/or uncoupling.

3 Claims, 8 Drawing Figures



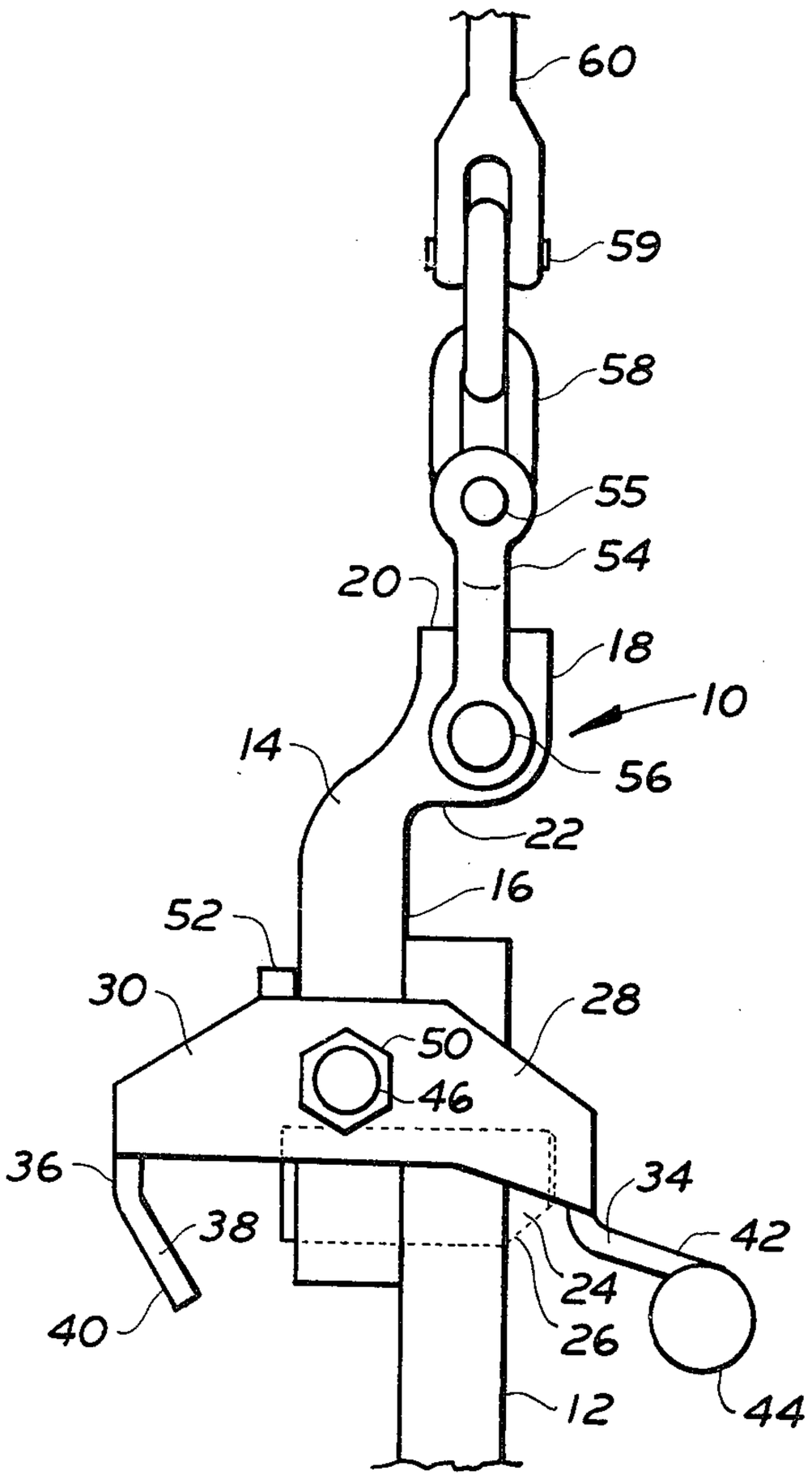

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FIG. 1

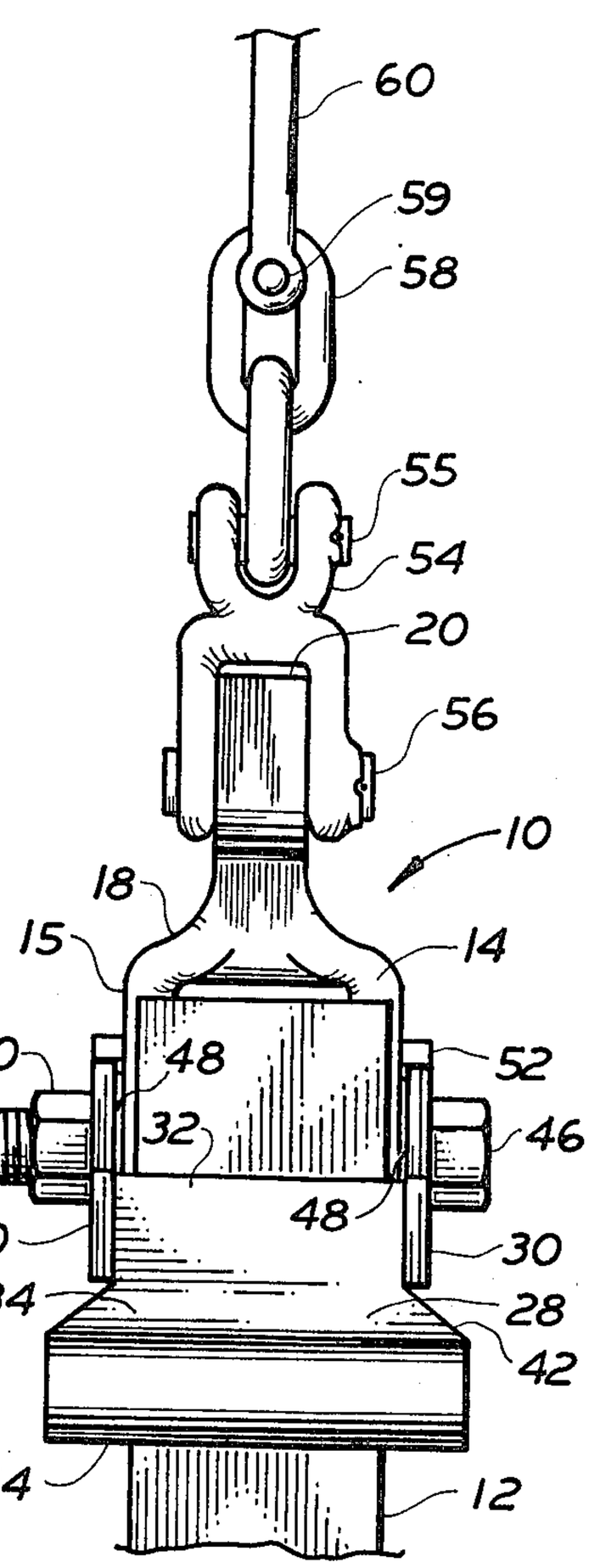
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FIG. 2

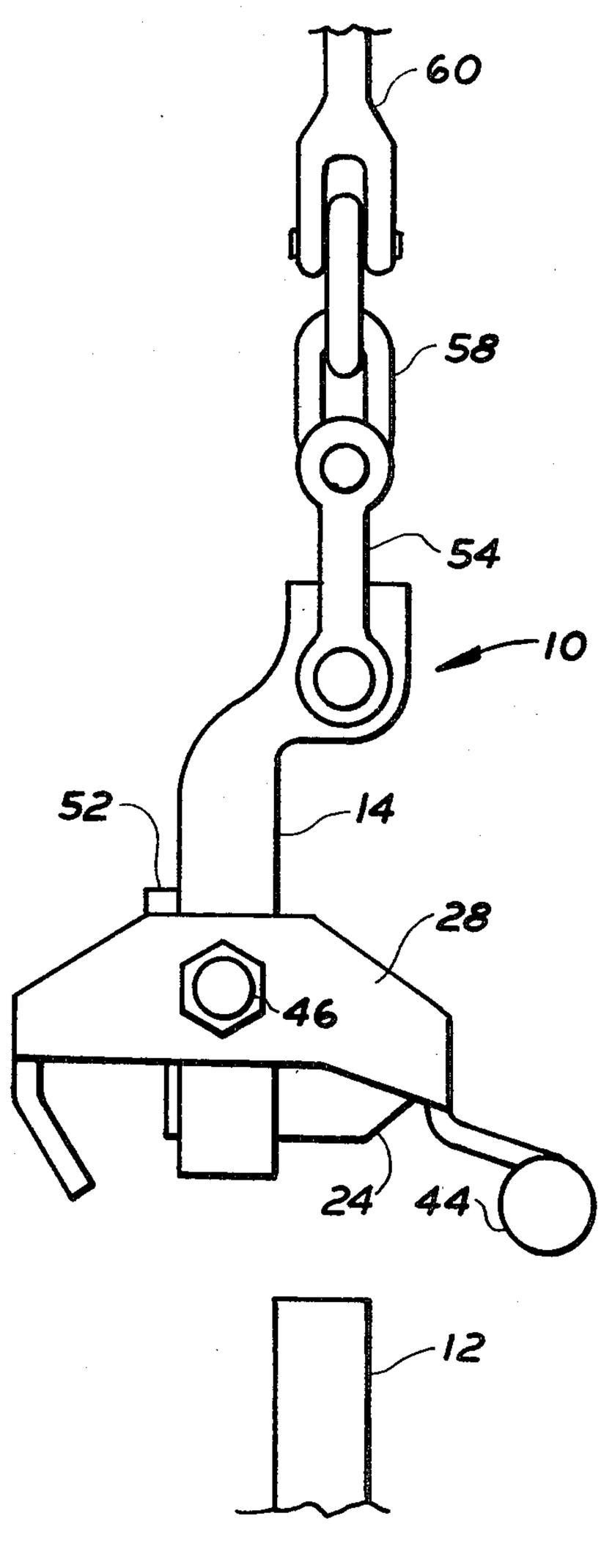

FIG. 3

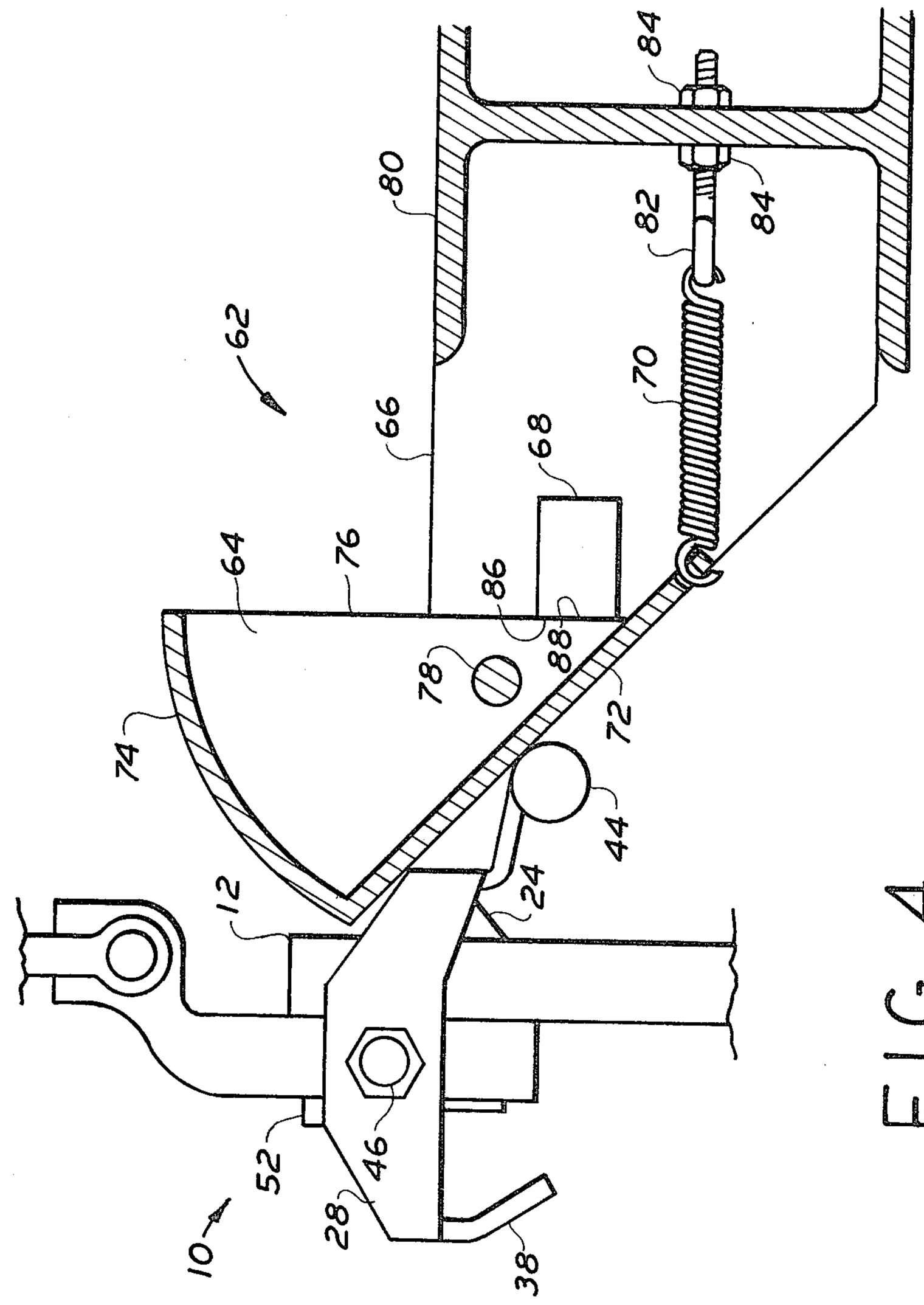

FIG. 4

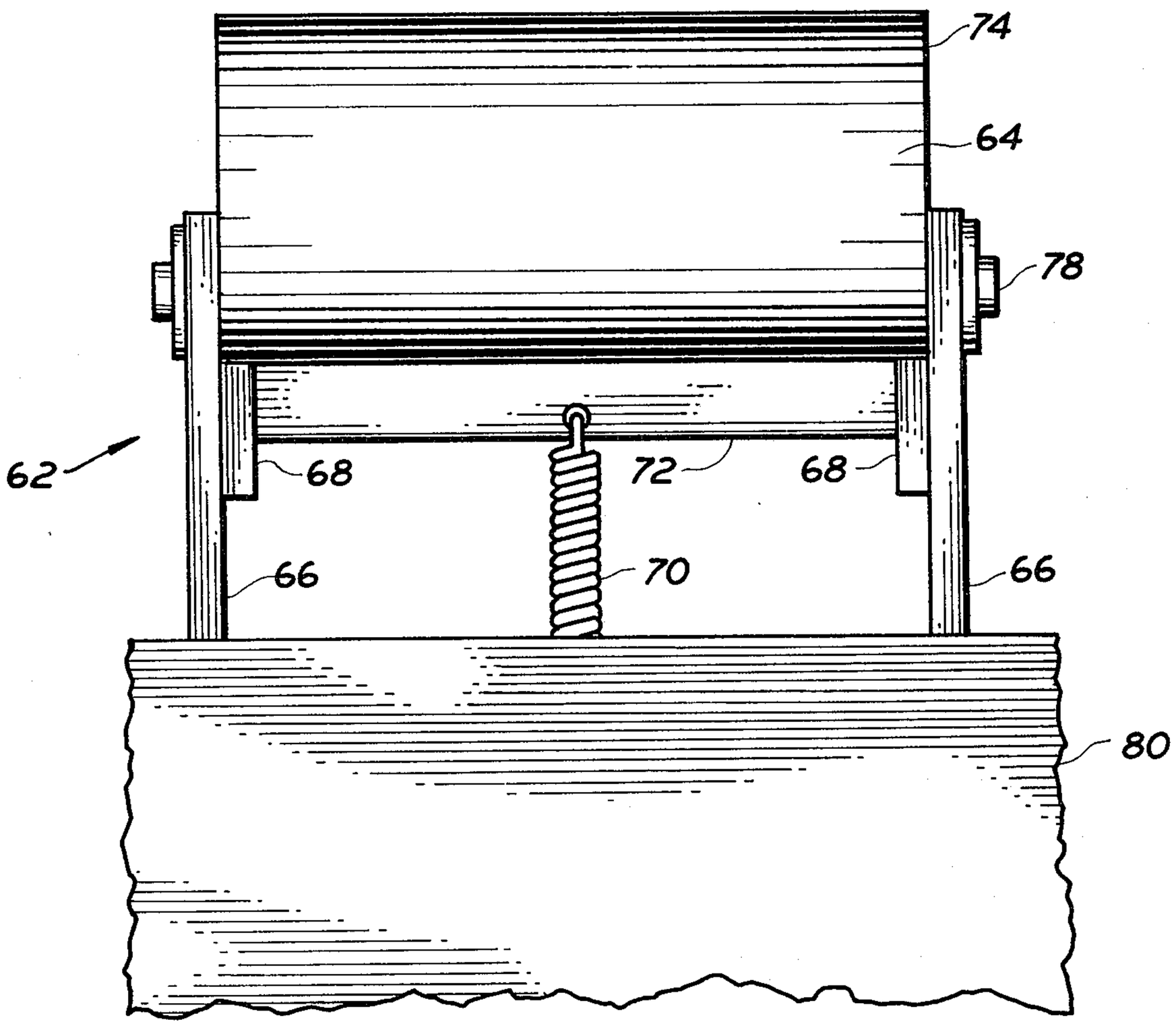

FIG. 5

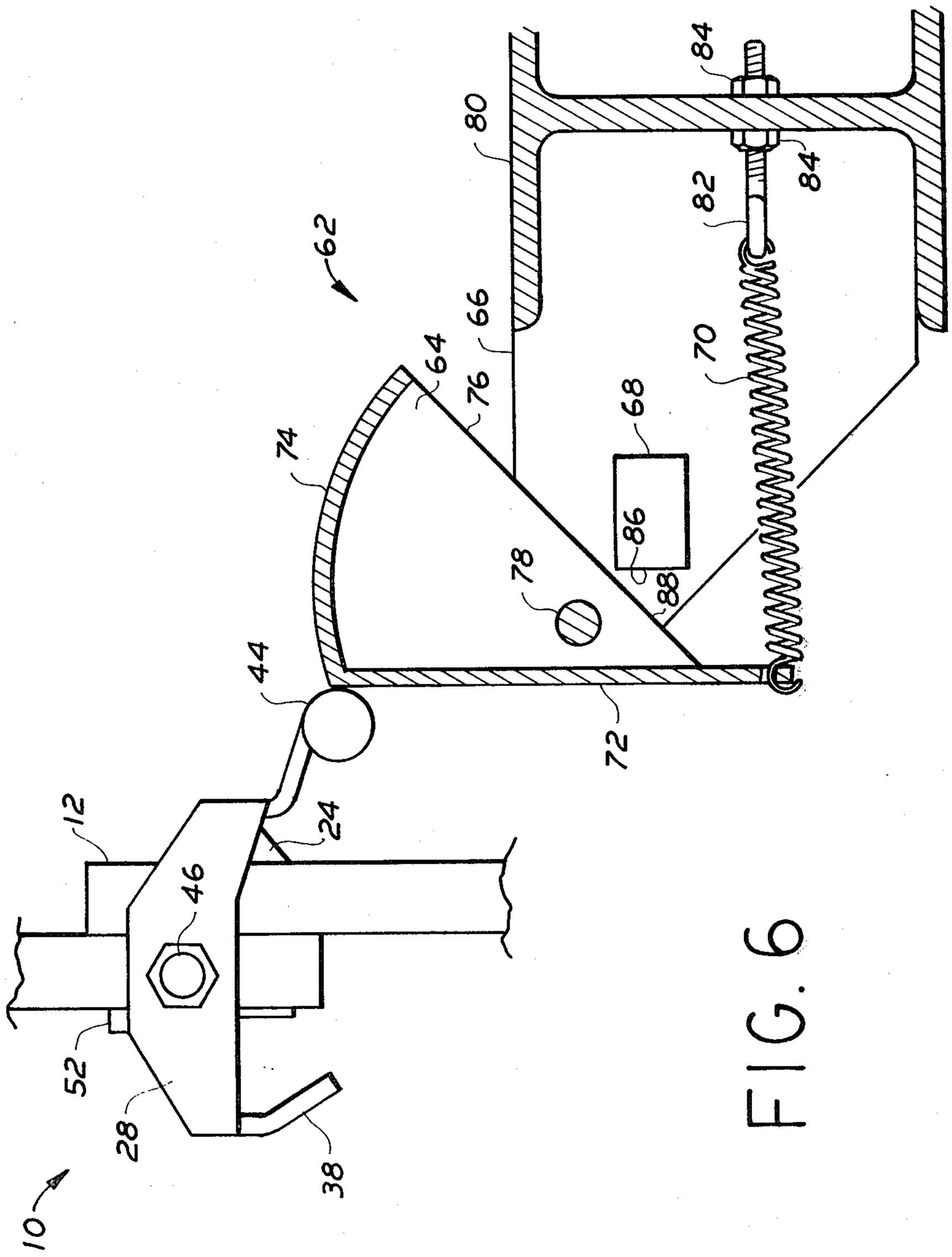

FIG. 6

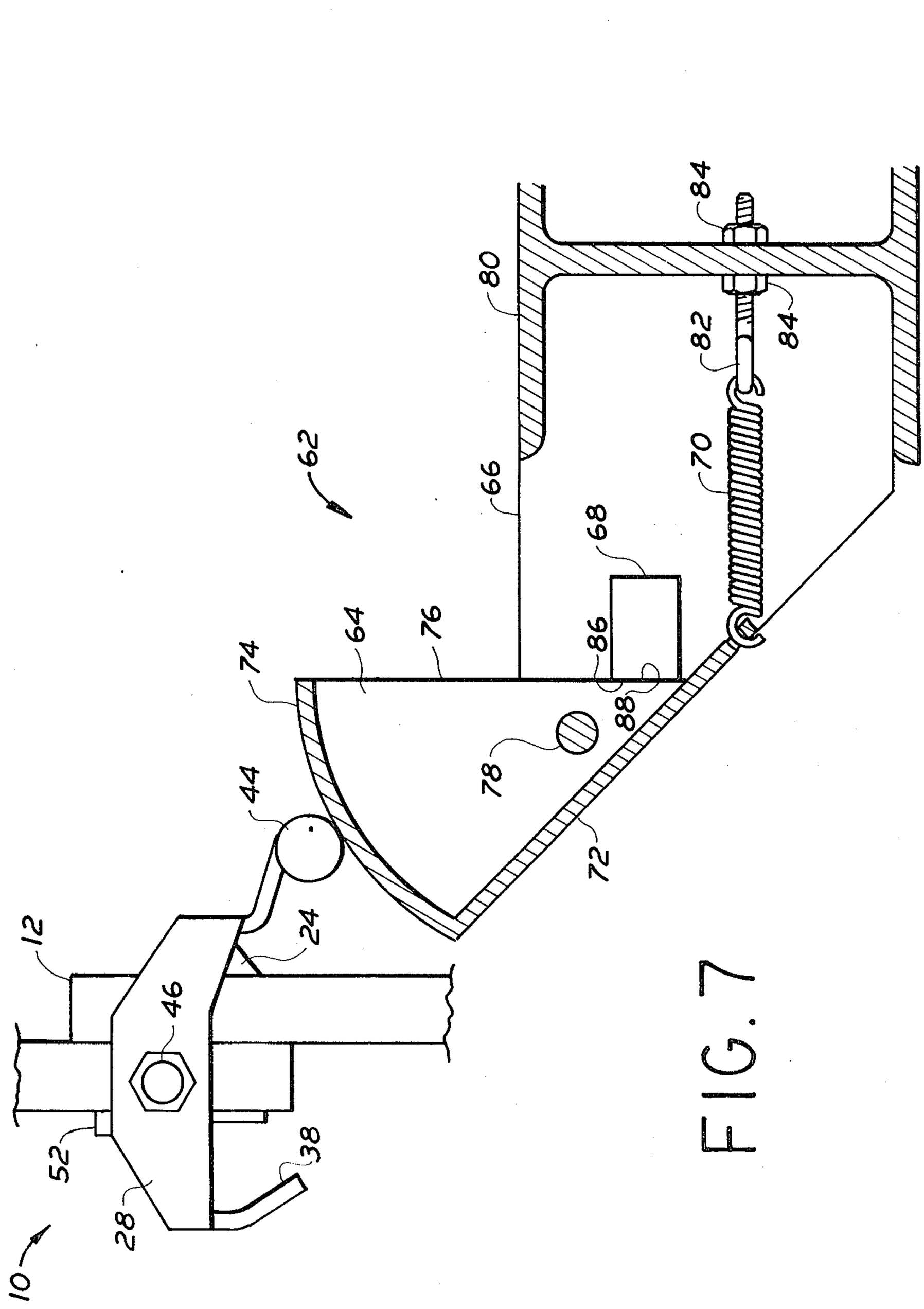

FIG. 7

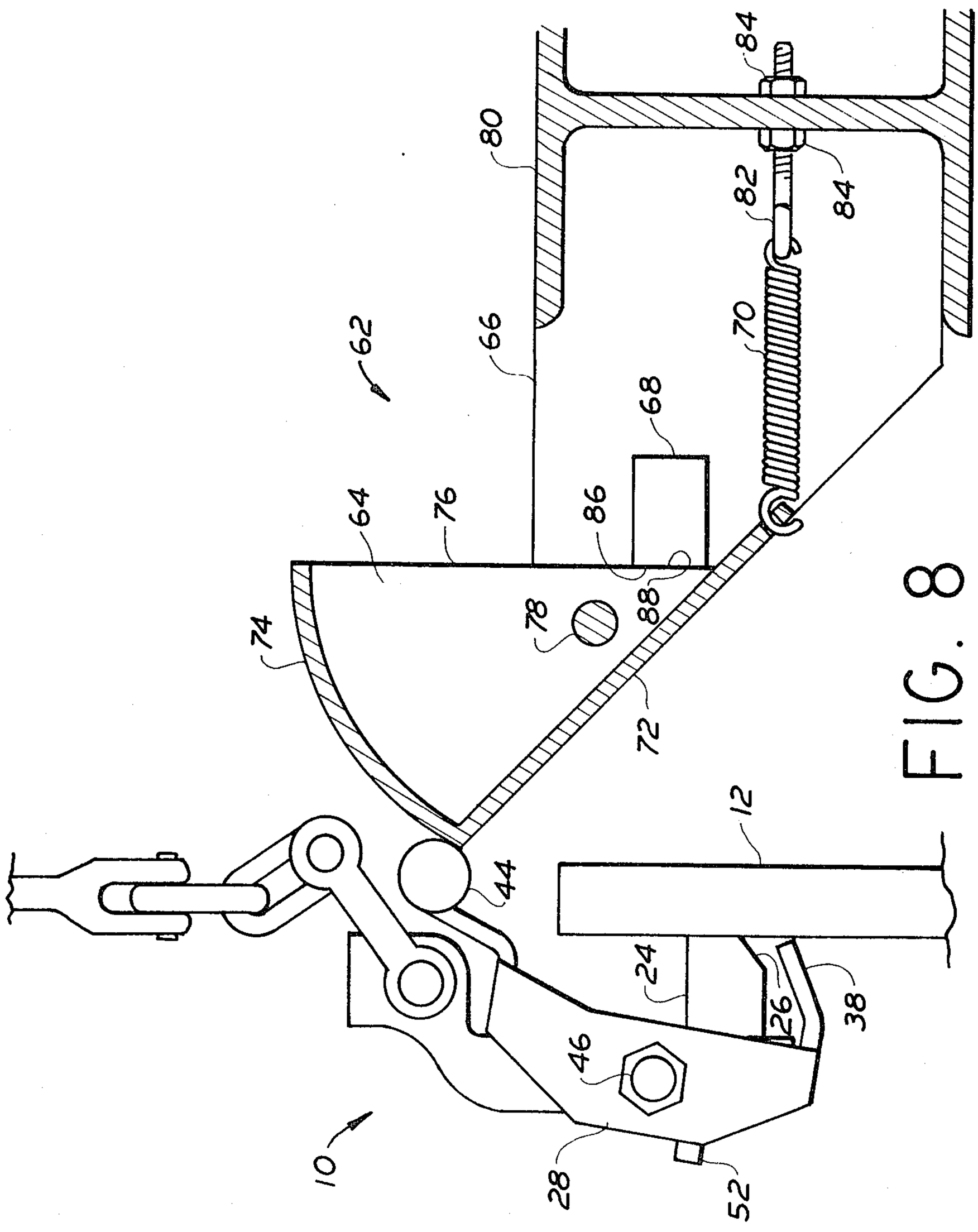

FIG. 8

SAFETY HOOK DEVICE

BACKGROUND OF THE INVENTION

(1) Field of Invention

This invention relates to a safety hook device that may be used in combination with an overhead transporting means, and the hook device is so adapted that the object to be hoisted and transported may be coupled and uncoupled automatically.

(2) Prior Art

In the transport of objects by overhead cranes or trolleys, it is often desirable that a safety hook be used in order to minimize danger to personnel, damage to the transported object, equipment or other material.

In the electrolytic production of aluminum, for example, large carbon anodes are used, and much of the transportation required in moving the anodes from station to station is by an overhead means. To produce an anode, the carbon is molded and baked into a block using a suitable binder. After baking, the anode block is assembled with a rigid metal bar extending vertically upward from the center of an upper portion of the block. The finished anodes are then transported to a smelting area where the anodes are inserted into an electrolytic cell containing a molten bath of aluminum salt. The rigid metal bar then functions as an electrical conductor and is suspended from a bus bar over the electrolytic cell.

Volume production of aluminum requires the use of large numbers of anodes since the anodes are consumed in the electrolytic process. It is desirable that a hook device be simple and quick to operate and also be provided with a safety feature to prevent involuntary disengagement. Handling and transporting the anodes are significant cost factors in producing aluminum, and speed in engaging, disengaging and transporting is important.

A prior hook device used for transporting anodes is comprised of a hoisting bar having a pin extending outward from a bottom portion of the bar, a slidable movable housing surrounding the bar and pin, and an attaching means on the end of the bar opposite the end having the outward extending pin for the purpose of attaching the hook device to the hoisting cable. To couple an anode bar, the housing is raised so as to be clear of the pin, the pin is inserted through an opening in the anode bar, and the housing is then dropped so as to surround the connection between the hook device and anode bar and thus prevent involuntary uncoupling. An adaptation of this device provides means for automatic raising of the housing and ejecting the pin at the point of desired uncoupling.

Other known safety hook devices include Cook U.S. Pat. No. 3,929,231 which discloses a hook device comprising a rectangular housing having a closed upper end, a movable pin mounted on a support structure attached to the outside of the housing and the pin coaxially aligned with a pair of holes through opposing walls of the housing so that the pin can be inserted through the housing and positive engagement between the pin and the housing obtained thereby. A pin actuating means activated by the crane operator is also provided so that the pin may be inserted and retracted through the holes of the housing walls. To couple an anode bar, the pin actuating means retracts the pin so as to permit entry of an upper portion of the anode bar. An opening through the anode bar is provided, the opening being

coaxially aligned with the holes in the housing walls. After the anode bar is properly positioned in relation to the housing, the actuating means causes the pin to be inserted through a hole in the first housing wall, through the opening in the anode bar, and then through the hole in the second housing wall. Involuntary uncoupling is prevented by locking the pin in place through the use of the actuating means. A positive lock is provided by the Cook device, but pin alignment is critical for positive engagement, and since the housing surrounds the upper portion of the anode bar having an opening for the pin, it is not possible to determine visually that the hook device and anode bar are positively coupled.

Muddiman U.S. Pat. No. 2,357,054 relates to a hoisting hook for apertured articles such as plating anodes. The hook portion is formed from a round rod having an elongate vertical shank with an attaching means to a hoisting means on its upper end. The lower end of the rod is bent so as to provide an outward projecting portion that is inserted into an opening in an upper portion of the anode. A latching means attached to a tubular sleeve surrounding the vertical portion of the hook can be raised or lowered by sliding the freely movable sleeve on the vertical portion of the hook. When the latching means is lowered, a bottom portion engages an upper portion of the anode preventing the anode from disengagement with the hook. Since the sleeve does not lock in place, it can be accidentally moved and involuntary disengagement could occur.

Other safety hooks for hoisting devices of interest are disclosed in Grove U.S. Pat. No. 2,986,421, Hohler U.S. Pat. No. 2,537,829, and Elliott U.S. Pat. No. 3,239,266.

It is an object of this invention to provide a hook device that is quick and simple to couple or uncouple from an object to be hoisted.

It is also an object of this invention that the device be provided with a safety feature which will prevent involuntary uncoupling from an object to be hoisted.

It is a further object of this invention that the device may be coupled or uncoupled by an automatic means.

These and other objects and advantages of this invention will be apparent from an examination of the appended drawings and the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

For purposes of illustration, the preferred embodiment of this invention is described for use in the transport of carbon anodes, but it is obvious that it might be employed in the transporting of any object having an opening suitable for attachment to the device as explained hereinafter.

FIG. **1** is a side elevation drawing of a hook device of this invention coupled with an anode bar.

FIG. **2** is an end elevation drawing of a device of this invention coupled with an anode bar.

FIG. **3** is a side elevation drawing of a hook device of this invention suspended above the top portion of an anode bar prior to coupling.

FIG. **4** is a side elevation drawing of a hook device of this invention coupled with an anode bar, and a cross-sectional view of an uncoupling device at the point of beginning the automatic uncoupling cycle.

FIG. **5** is a top view of the uncoupling device shown in FIG. **4**.

FIG. **6** is a side elevation drawing of the hook device coupled with an anode bar and a cross-sectional view of

the uncoupling device at the point of maximum rotation of the uncoupling device during the uncoupling cycle.

FIG. 7 is a side elevation drawing of the hook device coupled with an anode bar and a cross-sectional view of the uncoupling device after the hook device has cleared the uncoupling device during the uncoupling cycle.

FIG. 8 is a side elevation view of the hook device, anode bar and a cross-sectional view of the uncoupling device at the point of uncoupling in the uncoupling cycle.

DESCRIPTION OF PREFERRED EMBODIMENT

Referring now to FIGS. **1** and **2**, a hook device **10** of this invention is shown coupled with an upper portion of an anode bar **12**. The anode bar **12** is rectangular in cross section and extends vertically upward from a carbon anode having the lower end of the bar **12** embedded therein. The hook device includes a frame member **14** which is a casting having a rectangular block base portion **16** and an inverted generally Y-shaped portion **18** with ends of the arms **15** of the Y joined to portions of the top surface of the base portion **16**. The stem **20** of the Y-shaped portion **18** is offset by a curved portion **22** from the base portion **16** so that the longitudinal axis of the stem **20** is coaxially aligned with the longitudinal axis of the anode bar **12**. A coupling rod **24** extends outward from the center of a bottom portion of the surface on the base portion **16** adjacent to the anode bar **12**. The coupling rod **24** is circular in cross section and has a beveled surface **26** on a bottom portion of the end of the rod **24**.

A housing **28** has arm members **30** spaced apart on both sides of the base portion **16** of the frame member **14**. An upper portion **32** of a first plate **34** is joined on each end to end portions of the inner surfaces of arm members **30** outward of the outermost portion of the coupling rod **24** and a first portion **36** of a second plate **38** is joined on each end to end portions of the inner surfaces on the opposite end of arm members **30**. Extending downwardly and inwardly toward the anode bar **12** from the bottom of a first portion of second plate **38** is a second portion **40**. Extending downwardly and outwardly away from the anode bar **12** is a second portion **42** of first plate **34**. A counterweight **44**, which is a rod circular in cross section, is attached longitudinally on a portion of its circumferential surface to a portion of the bottom edge of first plate **34**.

A bolt **46** passes through concentrically aligned openings in the arm members **30**, frame member **14**, and spacer washers **48**. The opening through the frame member **14** is of sufficient size to permit the bolt **46** to freely rotate about its longitudinal axis without restriction. Spacer washers **48** are provided between frame member **14** and arm members **30** to insure that clearance is maintained between the frame member **14** and arm members **30** so that the housing **28** and bolt **46** assembly may freely rotate about the longitudinal axis of the bolt **46** without restriction. A nut **50** is tightened on the bolt **46** with sufficient torque to secure the assembly without causing excessive pressure on spacer washers **48** that would restrict rotation of the assembly. The housing **28** is adapted to rotate about the longitudinal axis of the bolt **46** from the force of gravity. An imbalance in portions of the housing extending outward from the bolt **46** is created by making the portion having the first plate **34** and counterweight **44** exceed the weight of the portion having the second plate **38**.

A stop bar **52**, having a square cross section, is attached to portions of the upper edges of the arm members **30** to restrict the rotation of the housing **28** from the effect of gravity when the housing **28** is in a coupling position as shown in FIG. **1**. Although the stop bar **52** is shown in this preferred embodiment as being attached to the housing **28**, it could alternately be attached to the frame member **14**. Coupling and restriction of rotation of housing **28** will be explained in detail later.

A first shackle **54** is attached to an upper portion of the stem of the Y **18** of the frame member **14** by a fastener means **56** extending through concentrically aligned openings in the bottom end of shackle **54** and frame member **14**. A chain **58** having a plurality of links is connected to the first shackle **54** by fastener means **55** extending through concentrically aligned holes in the upper end of the shackle **54** and the bottom link of the chain **58**. The other end of the chain **58** is attached to a second shackle **60** by a fastener means **59** extending through concentrically aligned openings in the bottom end of the second shackle **60** and the top link of the chain **58**.

The upper end of the second shackle **60** is connected to an overhead transporting means, and thus the shackles **54**, **60** and chain **58** provide a flexible linkage between the hook device **10** and the overhead transporting means.

The overhead transporting system may be a trolley mounted on an overhead rail or rails with the flexible chain linkage affixed thereto or it may be an overhead crane having a hoisting means affixed to the flexible linkage.

To operate an apparatus of this invention, a transporting means attached to the hook device **10** through the flexible linkage comprising the first and second shackles **54**, **60** and chain **58** is positioned over the anode bar **12** as shown in FIG. **3**. The housing **28** is in a horizontal or coupling position in relation to the vertical frame member **14**, and since the counterweight **44** and other portions of the housing **28** on the counterweight side of the bolt **46** exceed the weight of those portions of the housing **28** on the opposite side of the bolt **46**, and a portion of the vertical inner surface of bar stop **52** is in contact with a portion of an outer surface of frame member **14**, the housing **28** is maintained in its essentially horizontal position.

The hook device **10** is then lowered or the anode and anode bar **12** assembly is raised by an elevator (not shown) until the hook device **10** and anode bar **12** are in a position to be coupled with one another.

The housing **28** is rotated counterclockwise by causing counterweight **44** to be raised until coupling rod **24** is accessible for insertion through an opening in anode bar **12**. After anode bar **12** has been coupled to the hook device **10** by inserting coupling rod **24** through the coupling opening in the bar **12**, the raising force is removed from counterweight **44** and the force of gravity causes the counterweight **44** to drop rotating the housing **28** clockwise until stop **52** strikes the frame member **14**. As shown in FIG. **1**, the hook device **10** is positively coupled with the anode bar **12** partially contained within the housing **28** and involuntary uncoupling is prevented. The coupling operation as just described is done manually, but as will be explained later, adaptations may be made to provide automatic coupling.

After making a coupling in the aforesaid manner, the elevator is lowered or the hook device raised and the

anode and anode bar **12** assembly can be transported to a desired location without fear of uncoupling.

A unique feature of this invention is its adaptability for automatic uncoupling, and an example of an uncoupling device and method of uncoupling will now be described. FIGS. **4**, **6**, **7** and **8** show a hook device of this invention cooperating with uncoupling apparatus at an uncoupling location. FIG. **5** is a top view of the uncoupling apparatus when it is in a position as shown in FIGS. **4**, **7** and **8**. The uncoupling device **62** comprises an uncoupling cam **64**, two spaced apart cam support plates **66**, a pair of spaced apart cam stop blocks **68**, a cam spring **70**, and eye-bolt **82**. The uncoupling cam **64** is comprised of a rectangular shaped bottom plate member **72**, an arcuate plate member **74**, a pair of spaced apart wedge-shaped side plate members **76**, and a pivot rod **78**. The bottom plate member **72** is joined along its outermost edge to a bottom portion of the inner surface of the arcuate member **74**. The side plate members **76** have an arcuate outer edge with a radius equal to the radius of the arcuate plate member **74** and are in a spaced apart relationship attached to the opposing ends of the bottom plate member **72** and arcuate member **74**. A pivot rod **78** extends longitudinally through coaxially aligned openings in portions of the side plates **76** near the wedge points and portions of the rod **78** extend through the side plate members **76**.

The uncoupling cam **64** is pivotally attached to the support plates **66** by inserting the extended portions of the rod **78** through coaxially aligned openings in outer portions of the support plate members **66** and attaching fastener means on the ends of the rod **78** to prevent longitudinal movement. The support plate members **66** are attached to a structural member **80** along portions of the top and bottom edges and the end edge connecting the top and bottom edge portions of the support members **66**. Thus, the uncoupling cam **64** is contained within the support members **66** and is free to rotate about the longitudinal axis of the pivot rod **78**.

A spring **70** is attached at one end to a center portion near the inner edge of the bottom plate member **72**. The opposite end of the spring **70** is attached to the eye of an eye-bolt **82** which, in turn, is attached to the structural member **80** by retaining nuts **84**.

Stop blocks **68** are attached to portions of the inner surface of the support plates **66** and are disposed so that when uncoupling cam **64** is in the uncoupling position as shown in FIGS. **4**, **7** and **8**, one edge **86** of the stop block **68** bears against a portion of an edge **88** of the side plate **76** and thus prevents the cam **64** from rotating about the longitudinal axis of the pivot rod **78** in a counterclockwise direction from the force of gravity but does not prevent clockwise rotation, as will be explained later.

At the uncoupling location, the uncoupling apparatus **62** is rigidly attached to a support member **80** directly above an elevator means (not shown). The distance between the platform of the elevator means in its lower position and the uncoupling apparatus **62** is sufficient to accommodate the full extent of an anode, anode bar **12** and coupled hook device **10**.

To perform the uncoupling operation, the transporting means is used to transport the anode coupled to the hook device **10** to the uncoupling location. As the transporting means approaches the uncoupling location, the anode, anode bar **12** and coupled hook device **10** are positioned in a vertical direction so as to be immediately below the uncoupling device **62** and above the elevator means. Thus positioned vertically, the anode is then moved directly over the elevator means and the elevator is raised so as to come into contact with the anode.

As the elevator is raised, the weight of the load is transferred from the transporting means to the elevator, and the flexible linkage between the transporting means and the hook device **10** is allowed to become slack. As can be seen in FIG. **4**, the structure of the hook device permits passage of the portion above the counterweight **44** without making contact with the uncoupling cam **64**.

The rising coupled hook device **10** and anode bar **12** strike a portion of the bottom plate **72** with a portion of the counterweight **44** as shown in FIG. **4**. Since the housing **28** is restrained from rotating by stop bar **52**, the uncoupling cam **64** rotates in a clockwise direction about the longitudinal axis of the pivot rod **78** and flexes spring **70** due to the force of counterweight **44** bearing on plate **72**. Rotation of the cam **64** and flexing of the spring **70** continues until the counterweight **44** reaches the outermost edge of the bottom plate **72** as shown in FIG. **6**. Further raising of the elevator causes the counterweight **44** to clear the edge of the bottom plate **72** and the flexed spring causes the cam **64** to rotate in a counterclockwise direction until the opposing edge surfaces **86**, **88** of the stop blocks **68** and side plates **76** contact one another preventing further rotation and fixing the cam device in the uncoupling position as shown in FIG. **7**.

With the portion of the anode bar **12** coupled to the hook device **10** above the uncoupling cam **64**, the elevator is then lowered. Since the cam **64** is restrained from rotating by stop blocks **68**, continued lowering of the anode load causes the housing **28** to rotate in a counterclockwise direction about the longitudinal axis of the bolt **46**. An edge portion of second plate **38** strikes a portion of anode bar **12** which, in turn, causes bolt **46** bearing against the frame **14** to push the frame **14** outward away from the anode bar **12** and withdraw coupling rod **24** from the opening in anode bar **12**. FIG. **8** shows the relative positions of the hook device **10** and the cam device **62** at the point of uncoupling. The coupling rod **24** has been withdrawn from the opening in the anode bar **12** a sufficient distance so that only a portion of the rod **12** having the beveled surface **26** remains within the opening, and the counterweight **44** is prepared to clear the outer surface of the arcuate plate **74**. When the counterweight **44** clears the surface of the arcuate plate **74**, the force of gravity causes the counterweight **44** to fall, rotating the housing **28** in a clockwise direction and coincidentally ejecting the coupling rod **24** from the opening in the anode bar **12** and completing the uncoupling operation.

Although the automatic uncoupling feature of this invention has been described with the coupled assembly of the hook device **10** and anode bar **12** moving vertically in relation to an uncoupling device, it is obvious that other uncoupling means could be employed to accomplish this purpose including an uncoupling means moving vertically in relation to a stationary coupled assembly.

It is also obvious that a means for coupling automatically in a manner similar to the above-described uncoupling operation could be provided if desired. Coupling automatically could be accomplished, for example, by providing a vertical guideway for the hook device **10** above an anode bar at a coupling location. As the hook device is lowered by the hoisting means in the guideway, a cam device similar to the above-described un-

coupling device could be positioned in relation to the hook device and anode bar so that the arm member is rotated to permit coupling.

What is claimed is:

1. A hook device for attachment to an overhead transporting means and adapted for automatic uncoupling from a coupled object comprising:

(a) a vertical frame member having an upper portion adapted for attachment to an overhead transporting means and a lower portion having a coupling rod projecting generally horizontally therefrom for inserting into an opening in an object to be transported;

(b) a housing comprising two arm members disposed generally parallel to said coupling rod along opposite sides of said frame member and pivotally attached to said frame member about a horizontal axis with first portions of said arm members extending outward beyond the outermost extent of said coupling rod from said horizontal axis and a second portion extending outward from said horizontal axis in the opposite direction; a first end plate connecting the outer ends of the first portions of said arm members and having a portion projecting downwardly and outwardly from said arm members; a counterweight attached to the projecting end of said first end plate; a second end plate connecting the ends of the second portions of said arm members and having a portion extending downwardly and inwardly from said arm members; and a stop bar attached to second portions of said arm members and having a side surface of said stop bar adjacent to and bearing against said frame member along the side surface opposite said coupling rod; and said housing so adapted that the combination of the first portions of said arm members, said first end plate, and said counterweight are in imbalance about said horizontal axis with and heavier than the combination of the second portions of said arm members, said second plate, and said stop bar.

2. A hook device for attachment to an overhead transporting means and adapted for automatic uncoupling from a coupled object comprising:

(a) a vertical frame member having an upper portion adapted for attachment to an overhead transporting means and a coupling rod projecting generally horizontally from a lower portion of said frame member for inserting into an opening in an object to be transported;

(b) a housing pivotally attached to said frame member about a horizontal axis and having a first portion enclosing at least a portion of said coupling rod for retaining a coupled object on said coupling rod extending outward from said horizontal axis in imbalance with a second portion extending outward from said horizontal axis in the opposite direction and having said enclosing portion heavier than said second portion; and a stop means for preventing gravitational rotation of said housing about said horizontal axis when said enclosing portion encloses said coupling rod.

3. Apparatus as defined in claim 2 wherein said housing comprises: arm members disposed generally parallel to said coupling rod along opposite sides of said frame member and pivotally attached to said frame member; a first end plate connecting outer ends of said arm members beyond the outer end of said coupling rod and having a portion projecting downwardly and outwardly from said arm members; a second end plate connecting outer ends of said arm members opposite the end having said first end plate attached thereto and having a portion extending downwardly and inwardly from said arm members; a counterweight attached to the projecting end of said first end plate; and wherein said stop means is a bar attached to second portions of said arm members and adjacent to and bearing against said frame member along the side surface opposite said coupling rod.

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